Claims:

1. A system for measuring strain experienced by a structure, said system comprising:

a) a sensor including:

i) a body having an electromagnetic resonator, said electromagnetic resonator adapted to produce a response signal in response to an interrogation signal, said body being coupled to said structure to allow said strain to alter the resonance properties of said electromagnetic resonator thereby altering said response signal; and,

ii) a coupler coupled to said body, said coupler adapted to transfer said interrogation signal into said electromagnetic resonator and transfer said response signal out of said electromagnetic resonator; and,

an interrogator being adapted to generate and transmit said interrogation signal to said sensor, said interrogator being further adapted to receive said response signal.

2. The system of claim 1, wherein said electromagnetic resonator is a dielectric resonator.

3. The system of claim 1, wherein said electromagnetic resonator is an electromagnetic cavity.

4. The system of claim 3, wherein said electromagnetic cavity is rectangular.

5. The system of claim 3, wherein said electromagnetic cavity is cubic.

6. The system of claim 3, wherein said electromagnetic cavity is cylindrical.

provided. Over time these wires can corrode and compromise the integrity of the monitoring system. In addition, fiber-optic units can be difficult to install and can be subject to temperature drift. Furthermore, when the connections linking these sensor systems break then the monitoring system will not function.

[0007] The second group of prior art sensors comprise passive sensors that do not require a physical connection. Passive sensors include acoustic sensors and sensors that employ passive circuits for detecting strain.

SUMMARY OF THE INVENTION

[0008] The present invention is directed towards a sensor system and method for measuring strain experienced by a structure. The sensors of the sensor system would be installed into a structure such as a bridge, building or the like, to detect the strain experienced by the structure. Several sensors can be strategically placed at various locations of the structure that are susceptible to forces. The sensors do not require a source of power and could be activated on demand by a remote interrogator which could be brought within relative proximity to each sensor to activate and record measurements from each sensor individually.

[0009] Each sensor has an electromagnetic resonator such as, for example, an electromagnetic cavity having a resonant frequency that is related to the dimensions of the cavity. The dimensions of the cavity are dependant upon the strain experienced by the structure. Accordingly, the strainexperienced by the structure would be represented by changes in the resonant frequency of the sensor. The interrogator utilizes an interrogation signal having a frequency content that matches the resonant frequency of the electromagnetic cavity. Upon excitation by the interrogation signal, the electromagnetic cavity would produce a response signal that is related to the resonant frequency of the cavity. The interrogator would process the response signal to determine the strain that is experienced by the structure.

[0010] Accordingly, in a first aspect, the invention is directed towards a system for measuring strain experienced by a structure. The system

wherein the magnitude of said strain experienced by said electromagnetic cavity is amplified by a factor equal to the ratio of said second length to said first length.

25. A method for measuring strain experienced by a structure, said method comprising:

a) coupling a sensor having an electromagnetic resonator to said structure;

b) providing an interrogation signal to said electromagnetic resonator to evoke a response signal; and,

c) receiving said response signal.

26. The method of claim 25, wherein said method further comprises processing said response signal to determine said strain.

27. The method of claim 25, wherein said electromagnetic resonator is an electromagnetic cavity and said method further comprises:

d) amplifying said strain in a mechanical fashion to amplify the magnitude of said strain experienced by said electromagnetic cavity.

28. The method of claim 25, wherein step b) comprises:

e) providing said interrogation signal as a continuous narrowband signal; and,

f) sweeping the center frequency of said narrowband signal in a sweep range that includes a resonant frequency of said electromagnetic resonator.

29. The method of claim 28, wherein step c) comprises processing said response signal to detect a minimum at a frequency within said sweep range indicative of the resonant frequency of said electromagnetic resonator.

30. The method of claim 25, wherein step b) comprises: